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# INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

CHICAGO 16, ILLINOIS

# GAS ABSTRACTS

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# 1. GAS INDUSTRY

## Canadian Pipe Line

Dack, W. L. TRANS-CANADA GAS LINE: A POLITICAL FOOTBALL. *World Petroleum*, 27, 64-66 (1956) May.

A summary of the current status of the trans-Canada natural gas pipe line. G. G. Wilson

## Information Service

FACTS AT THEIR FINGERTIPS. *Chem. Eng. News*, 34, 2762; 2764 (1956) June 4.

With today's increasingly complex chemical industry, the output of information and the demand for this information, management is facing the problem of developing practical, efficient methods of information gathering and dissemination. Carbide and Carbon Chemicals has met this problem with the establishment of a special Marketing Information Center. It serves the executive staff and various departments such as sales, market research, technical service, product development and advertising. One of its major functions is an answering service. Although the initial costs of establishing such a service was high, it has proved its worth repeatedly. C. A. Simms

## Research

Leedy, H. A. RESEARCH AND DEVELOPMENT FOR PROFIT: REPORT ON NATIONAL INDUSTRIAL RESEARCH CONFERENCE. *Research and Eng.*, 11, 18-26 (1956) June.

Stepped-up research and development has been the major key to sales and profits for many companies in the last five to ten years. With "Research for Profit" as its theme, the first annual National Industrial Research Conference, sponsored by the Armour Research Foundation of Illinois Institute of Technology, took a long hard look at three important aspects of industrial R & D: research budgets, research management's decisions, and research results. Author's Abstract

## Unaccounted-For Gas

Rohret, L. C. UNACCOUNTED-FOR GAS: WHERE DOES IT GO AND HOW CAN THESE LOSSES BE PREVENTED? *Amer. Gas J.*, 183, 28-30 (1956) June.

Unaccounted-for gas losses are generally thought of in terms of leakage. This accounts, however, only for a portion. The paper gives only a light sampling since each individual distribution network presents its own problems. The way of reporting gas losses and the sources and causes of unaccounted for gas are discussed. The classification of the causes are stated and a need of new standards is considered. G. Kunst

# 2. APPLIANCES

## Burners

Flynn, J. H. MULTI-FLAME GAS BURNERS. U. S. 2,748,848 (1956) June 5.

Kamm, W. I., Krautter, W., Staiger, K. (assigned to Stewart-Warner Corp.) RESONANT COMBUSTION DEVICE FOR HEATING ENGINES AND SIMILAR STRUCTURES. U. S. 2,746,529 (1956) May 22.

Keating, R. T. GAS BURNER. U. S. 2,746,532 (1956) May 22.

## Controls and Ignition

Eskin, S. G. (assigned to The Dole Valve Co.) THERMOSTAT AND OVER-TEMPERATURE GAS SHUT-OFF VALVE. U. S. 2,749,043 (1956) June 5.

Gilmore, W. H. and Gilmore, C. R. (assigned to East 134 Company) RECIRCULATING PILOT AND BURNER. U. S. 2,748,847 (1956) June 5.

Loveland, R. S., and Maher, A. J. (assigned to Minneapolis-Honeywell Regulator Co.) OVEN CONTROL. U. S. 2,746,686 (1956) May 22.

Marshall, W. E. and Robinson, W. J. (assigned to Minneapolis-Honeywell Regulator Co.) BURNER CONTROL APPARATUS. U. S. 2,748,845 (1956) June 5.

Smith, J. W. and Wagner, F. C. (assigned to Minneapolis-Honeywell Regulator Co.) COMBUSTION SAFEGUARD APPARATUS. U. S. 2,748,846 (1956) June 5.

## Valves

Reinhart, H. C. (assigned to Magic Chef, Inc.) DUAL GAS VALVES. U. S. 2,747,613 (1956) May 29.

Meusy, E. E. (assigned to Milwaukee Gas Specialty Co. SEALING MEANS. U. S. 2,747,834 (1956) May 29.

Seaman, L. V. GAS STOVE FUEL SUPPLY SYSTEM. U. S. 2,746,533 (1956) May 22.

### Ventilation

Pledger, W. A.) assigned to The Pledger Ventilator Co.) KITCHEN STOVE VENTILATOR. U. S. 2,746,449 (1956) May 22.

### Heating–Cooling

Newton, Alwin B. YOU CAN FIGURE ADD-ON COOLING. *Gas Heat*, 7, 37-39, 42 (1956) June.

An existing forced warm-air system may or may not have the air capacity to do as good a job on cooling as it does for heating. After your heat gain calculations tell you how much cooling the home needs, make sure the system will handle it. The author's method of doing this is designed for the practical heating and cooling man whose time means money.

Authors' Abstract

Pfennigwerth, P. L. and Baker, Merl. INTERMITTENT HEATING AND COOLING OF BUILDINGS. *Heatg, Pipg & Air Condg*, 28, 113-19 (1956) June.

A discussion of the problems associated with the intermittent heating and cooling of buildings is presented together with an explanation of the method of finite differences as a suitable technique for analysis. Equations are developed for applying the method to intermittent heating and cooling problems. Certain assumptions are introduced in the development, and pilot experiments were conducted for validation. The principal contribution of this presentation is the establishment of certain boundary conditions which enables use of the method of finite differences to determine the load requirements of intermittently heated or cooled buildings.

Authors' Abstract

Sandfort, J. F. BASIC THERMODYNAMICS OF HEATING AND COOLING SYSTEMS. *Air Condg, Heatg Ventilg*, 53, 82-99 (1956) June.

Thermodynamics deals with energy, transformations of energy, and the properties of matter. Heating and air conditioning engineering requires a sound working knowledge of certain thermodynamic fundamentals, but fortunately, only a narrow and elementary segment of thermodynamics applies to ordinary heating and air conditioning problems. The purpose of this article is to present, in logical sequence, those necessary thermodynamic fundamentals which do apply in these fields. Authors' Abstract

### Heat Pump

BELOW FREEZING AIR YIELDS HEAT IN NEW HEAT PUMP SYSTEMS. *Heatg, Pipg & Air Condg*, 28, 105-07 (1956) June.

The new heat pump applies the principle of reverse cycle refrigeration operating in stages. The compressors are switched automatically from single stage compression into compound compression when the outdoor air drops below a certain point. The heat removed by the refrigerant from the outdoor air may be used to produce hot water, which can be circulated throughout the building, or the hot refrigerant can be used directly in coils to provide forced warm air heating. Authors' Abstract

### Refrigerating Load

Ruthenburg, Louis. INCREASING LOAD AND PROFIT. *Butane-Propane News*, 18, 28-32 (1956) June.

This is a slight condensation of a talk which was delivered in introducing the latest line of Servel gas refrigerators to gas utility executives—hence the emphasis of the economics of utility gas marketing. The close parallel to LP-gas distribution will be obvious. It is so rich in basic philosophy and sound management ideas for your consideration.

Authors' Abstract

## 3. COMBUSTION AND INDUSTRIAL FURNACES

### Flame Research

Fine, B. D. and Wagner, P. SPACE HEATING RATES FOR SOME PREMIXED TURBULENT PROPANE-AIR FLAMES. Nat. Adv. Comm. Aeron. NACA TN 3277 (1956) June.

Rates of combustion of turbulent propane-air flames were determined in terms of the burning velocity and of the space conversion rate. The latter is defined as the ratio of the volume flow rate to the volume of the flame. The turbulent burning velocity was determined from the sur-

face midway between the flame envelopes. Arguments are presented concerning the lack of definition of turbulent burning velocity. The space conversion rate showed a simpler dependence on burner dimensions than the burning velocity. S. A. Weil

Williams, K. G., Woods, F. J., Johnson, J. E., and Carhart, H. W. PROBINGS INTO COOL FLAMES: PART II—DYNAMIC STUDIES AT SHORT RESIDENCE TIMES. Naval Res. Lab. NRL Report 4651 (1956) March 26: (Also PB 111994, 1-7, Feb.; PB 121,029, 22 (1956) March).

The low-temperature reaction of oxygen and n-hexane was evaluated from analysis of the product gases. The reactants were heated prior to mixing and the extent of reaction determined as a function of residence time, surface to volume ratio, reactant concentrations, and temperature. The extent of reaction exhibited a negative temperature coefficient over a 200° C. range. The temperature of maximum fuel consumption increased with surface to volume ratio. The dependence of extent of reaction on residence time indicated two reaction paths, the first showing a rate with an exponential dependence on time, the second showing a rate with a linear time dependence and proportional to the surface to volume ratio. S. A. Weil

### Nuclear Power

Van Zandt, J. E. ATOMIC POWER AND THE COAL INDUSTRY. *Publ. Util. Fortnightly*, 57, 881-86 (1956) June 21.

The rapidly developing atomic energy program is today one of the large coal consuming industries (20 million tons) and is expanding faster than U. S. coal production. Instead of coal mines being closed, estimates for 1980 indicate that coal will supply about 425 million KW (71%) and atomic plants 175 million KW (21%) of the electric power. Government investment in atomic power plants is not designed for future nationalized control, but for research and for protection of defense developments. Benefits to all fossil fuel lacking areas, U.S. and world, will result directly from nuclear power, and great national benefits in medicines, foods, electronics will be a byproduct. In addition, use of coal for synthetic gas and oil, metallurgy and chemicals will expand.

O. P. Brysch

Zmola, P. C. and Bailey, R. V. POWER REMOVAL FROM BOILING NUCLEAR REACTORS. *Amer. Soc. Mech. Eng., Trans.*, 78, 881-92 (1956) May.

A method is presented for calculation of power removal capacity of a boiling nuclear reactor. The discussion covers coolant moderated, solid or liquid fuel reactors. Performance charts are presented for idealized systems with uniform heat generation. W. G. Bair

### Steam Properties

Spencer, R. C., Meyer, C. A. and Baird, R. D. PROPERTIES OF STEAM AT HIGH PRESSURES — AN INTERIM STEAM TABLE. *Combustion*, 27, 57-60 (1956) June.

During the past years the steam conditions considered for central station steam generation and chemical process plants have increased above the limits of experimental investigations contained in currently published steam tables. The table described in this paper is a reasonable and consistent extension of the Keenan and Keyes steam tables into the region of 5500-10,000 psia and 32-1600 F. and will be useful in power systems calculations until tables by the ASME Steam Properties Research Project are available. Authors' Abstract

## 4. CARBONIZATION AND GASIFICATION

### Coal Grindability

Callcott, T. G. COAL GRINDABILITY—A STANDARDIZED PROCEDURE FOR THE DETERMINATION OF COAL GRINDABILITY AND A SURVEY OF THE GRINDABILITIES OF BRITISH COALS. *J. Inst. Fuel* (British), 29, 207-17 (1956) May.

A procedure, as developed by the British Coal Utilization Research Association, for the determination of the grindability of coal with a Hardgrove laboratory mill is outlined in detail. The percentage of ground product which passes a 200-mesh B.S. sieve represents the grindability index. The standard error of a determination is 0.2 and is independent of the type of coal and its index. Grindabilities for 128 British coals are tabulated (ranging from 28 to 2). The results suggest that the index is a first-order measure of the strength of the feed coal and is related to the structure of the coal.

E. J. Pyrcioch

## Dust Removal

Harlow, E. V. (assigned to Koppers Company, Inc.) PURIFICATION OF GASES. U. S. 2,-746,563 (1956) May 22.

This invention relates to the difficulties encountered when non-conductive ash accumulates on the electrodes of electrostatic precipitators used in flue gas purification. This ash can be made conductive and such trouble eliminated by catalytically oxidizing part of the $SO_2$ in the flue gas to $SO_3$. D. M. Mason

Van Vliet, J. APPARATUS FOR SMOKE ABATEMENT AND BY-PRODUCTS RECOVERY. U. S. 2,744,737 (1956) May 8.

An apparatus is claimed for separating particles (smoke, dust) from a gaseous stream, which comprises a chamber, or several in tandem, with baffles on the walls placed to deflect the gas stream, and with a shallow water reservoir at the base to wet and hold the particles. A rotary water slinger, of inverted cone form mounted vertically in the chamber is designed to lift the water by scoops and discharge it as sheets and droplets through the gas and to wet the baffled surfaces and wash down the particles into the reservoir. O. P. Brysch

## Gas Cooler

Otto, C. COKE OVEN GAS COOLER. U. S. 2,747,847 (1956) May 29.

Three-stage cooling of crude gas is achieved by liquor sprays in an inlet-pipe section, a lower tower section and a superimposed upper tower section, the liquors draining from each section into individual sump tanks in the base of the tower. Pumps draw the liquor from each sump for use in sprays for the previous stages, and baffles deflect the descending liquor to proper sumps. O. P. Brysch

## Gum Deposits

Sawyer, F. W. THE PROBLEM OF GUM FORMATION. *Gas J.* (British), 286, 607, 611 (1956) May 30.

Experience at Darlington with gum deposition in appliances due to evolution of nitric oxides from old deposits in a main is described. D. M. Mason

## Hydrogen Purification

Rosenblatt, E. F. (assigned to Baker & Co., Inc.) PURIFICATION OF COMMERCIAL HYDROGEN. U. S. 2,747,970 (1956) May 29.
Carbon monoxide and dioxide are removed from commercial hydrogen by conversion to methane over a supported ruthenium or rhodium catalyst at temperatures above 120° C.
E. B. Shultz

## Oil Gas

Chaney, N. K. THE THERMOFOR PYROLYTIC CRACKING PROCESS FOR THE PRODUCTION OF OIL GAS. Amer. Gas Assoc. Res. Bull. No. 7 (1956) April.
An analysis of the TPC process for manufacture of high Btu oil gas. The data obtained in pilot plant operation by Surface Combustion Corp. are compared to normal operating data from the Hall cyclic process. The TPC process is favored for the gasification of heavy oils due to a better product tar, coke production, and reduced plant cost for larger units (20,000 MCF/day). Much of the pilot plant data should be confirmed by additional operation.
W. G. Bair

Horner, G. M. THE SEGAS PROCESS FOR THE CATALYTIC REFORMING OF HYDROCARBONS. Amer. Gas Assoc., Opertg. Sect CEP-56-2 (1956) May 16-18.
The paper describes a process which has been developed in England for the production from heavy oil of gas with similar characteristics to those of manufactured city gas and the extension of the process to the use of other hydrocarbon feedstocks. It points out the lessons which have been learned from initial operating experiences and indicates how these have been translated into modified techniques and revised designs which now form the basis of an established process. Author's Abstract

## Reformed Methane

Fiumara, A. and Salvi, G. TERMODINAMICA E STECHIOMETRIA DELL'OSSIDAZIONE PARZIALE DEL METANO CON OSSIGENO LIBERO. (THERMO-DYNAMICS AND STOICHIOMETRY OF THE PARTIAL OXIDATION OF METHANE BY FREE OXYGEN). *Rivista dei Combustibili* (Italian), **10**, 267-84 (1956) April.
The authors have carried out thermodynamic

research on the reaction occurring in partial conversion of methane with pure oxygen or with air, and determined the reaction gas composition at equilibrium, for temperatures ranging from 800 to 1400° K, at 1 atm pressure, and for $O_2/CH_4$ ratios of from 0.455 to 0.715. The minimum $O_2/CH_4$ ratios were also determined by different temperatures above which no elemental carbon is formed.

Authors' Abstract

Markert, F. and Raichle, L. (assigned to Badische Anilin- u. Soda-Fabrik AG.) CATALYTIC METHOD FOR CONVERTING CARBON MONOXIDE AND STEAM INTO CARBON DIOXIDE AND HYDROGEN. U. S. 2,747,967 (1956) May 29.

In this shift process for conversion of carbon monoxide and steam to carbon dioxide and hydrogen the hot reacted gases are cooled by indirect heat exchange with circulating water, the partially heated water after additional heating with steam is used to heat the feed gas by direct contact.

E. J. Pyrcioch

METHANE REFORMING—VISIT TO POINT OF AYR. *Gas J.* (British), 286, 546,248-49 (1956) May 23.

A description of the Wales Gas Board reforming plant at Point of Ayr is presented. A 20-year contract has been made between the National Coal Board and Wales Gas Board for the purpose of a joint experiment in the utilization of methane from coal mines and provides for the supply of 4¼ mill. cu ft per week of gas from the colliery, at a calorific value of 980 B.Th.U. per cu ft and a pressure of not less than 6 lb per sq in gauge. Methane, with a specific gravity of 0.56, is not in itself interchangeable with the North Wales grid gas from Shotton Station, which is a mixture of coke oven gas and blast furnace gas with a calorific value of 500 B.Th.U. per cu ft and specific gravity of 0.42. The principle adopted for utilization of the methane is that of mixing the methane with carbon monoxide, hydrogen and inert gases, to produce a mixed gas which will have similar combustion characteristics to those of the grid gas from the Shotton Station.

Selected Extracts

## Sulfur Removal

Heitz, R. G. and Rocklin, A. L. (assigned to The Dow Chemical Co.) REMOVAL OF OTHER ACID GASES FROM MIXTURES CONTAINING CARBON DIOXIDE. U. S. 2,747,962 (1956) May 29.

This invention provides a method whereby acid gases such as $H_2S$ or HCN may be removed preferentially from a gas stream containing $CO_2$. For this purpose the gas mixture containing $CO_2$ and another acid gas is brought into contact with the surface of an alkaline liquid under conditions such that the gas phase is in contact with the alkaline liquid for a period of not to exceed 0.3 sec and preferably 0.05 sec or less. The alkaline liquid may be such as an alkali metal hydroxide, alkali metal phosphate, alkanolamine or amine solution.

D. M. Mason

Pigache, P. G. DRY PROCESS FOR THE RECOVERY OF SULFUR FROM GASES. U. S. 2,747,968 (1956) May 29.

This invention relates to a dry process for the separation and recovery of sulfur compounds from gases regardless of whether they are in the form of $H_2S$, $CS_2$, COS, $SO_2$ $SO_3$, thiophenes, mercaptans, thioethers or other sulfur compounds. The process consists of contacting the gas at temperatures between 100 and 300° C. with a member of the group consisting of divided copper, nickel, cadmium, and oxides and salts of these metals, which may be supported on a carrier such as alumina or the like, and to which may be added a promoter from the group chromic acid, nickel oxide, and nickel sulfide. For regeneration the sulfur-containing metal compound is submitted at a higher temperature, preferably 350-700° C., to the action of an atmosphere containing either $H_2$, water vapor, CO, or air, or several of these gases in succession.

D. M. Mason

## Synthesis Gas

Retailliau, E. R. (assigned to Esso Research and Engineering Co.) GAS MANUFACTURE. U. S. 2,748,179 (1956) May 29.

Fuel and synthesis gases are formed by oxidative cracking of low-molecular weight hydrocarbons in presence of oxygen in the combus-

tion space of an unfired internal combustion engine. For instance, n-pentane may be vaporized and blended with air or oxygen and conducted to the cylinder of the engine. Heat of compression causes reaction, giving carbon monoxide, hydrogen, methane, aromatics and some oxygenated compounds such as carbonyls and alcohols. Carbon dioxide formation is minimized by not using an electric spark. No reaction occurs until a critical temperature of about 900°F is achieved at a compression ratio of 9.49 to 1. When air is used, heating value of the product gas is about 500 Btu/SCF. The production of a million cubic feet per day from one compressor with 13½ in diameter, 20-in stroke running at 200 RPM is claimed. The inventor suggests the process as a convenient and inexpensive means for gas manufacture in small communities. E. B. Shultz

### Tonnage Oxygen

Lyons, C. J. and Batchelder, H. R. TONNAGE OXYGEN PRODUCTION, 1956. Amer. Gas Assoc. Opertg. Sect. Paper CEP-56-16 (1956) May 16-18.

This report is the last of a series on "Current Status of Tonnage Oxygen", which have been prepared annually for the A.G.A. since 1948 and are now to be discontinued. Included is a brief summary of the basic air-separation processes used commercially for tonnage oxygen plants of three different manufacturers. The economics of tonnage oxygen production is discussed as regards plant investment cost and operating costs. Plant investment cost which varies with plant size is estimated as $5,000 per ton daily capacity for a 500-ton per day plant. The total operating cost for a plant of the same size is estimated at $5.50 per ton. The influence of oxygen cost on the cost of pipeline gas from coal is discussed briefly. A tabulation of tonnage oxygen plants built by U. S. companies is presented. E. J. Pyrcioch

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Sykes, K. N. CARBON SULFUR REACTIONS p. 166

## 5. NATURAL GAS AND NATURAL GAS CONDENSATES

### Compression

Walsh, E. A. OPERATION AND MAINTENANCE OF GAS TURBINES. *Petrol. Eng.*, 28, D46, 48, 50 (1956) May.

A discussion of the gas turbine operation and maintenance practices used by El Paso Natural Gas Co. and an outline of the inspection procedure used is given. G. G. Wilson

GAS TURBINES PASS TEST. *Petroleum Week*, 2, 32-33 (1956) June 8.

Creole has been inspecting and overhauling their ten 6000 H.P. gas turbines used in the Lake Maracaibo repressuring project, after 20 months of almost trouble-free operation. A second plant is planned for the near future.
B. E. Eakin

### Conditioning

Van Der Pyl, L. M. BIBLIOGRAPHY ON GAS CONDITIONING. Amer. Gas Assoc. Opertg. Sect. Paper CEP-56-7 (1956) May 16-18.

A bibliography on the literature concerned with gas purification, gas drying, dust removal, adsorption theory and extraction, which in conjunction with a previous article includes subject matter up to November 1955. P. B. Tarman

### Drilling

Gray, G. R., Allen, G. G. and Tschirley, N. K. GULF COAST DRILLING MUD PRACTICES DEMAND ATTENTION TO SPECIAL PROBLEMS. *World Oil*, 142, 155-158, 160 (1956) June.

This article reviews some of the drilling mud practices utilized on the Gulf Coast which have resulted in saving time, money, and in some cases, the well. B. E. Eakin

Joynt, K. R. and Massad, A. H. DIRECTIONAL DRILLING FOR SALT DOME OIL PRODUCTION. *World Oil*, 142, 192, 194, 199, 202 (1956) June.

An outline is presented of the two basic methods which are available for drilling piercement

type salt domes. Exploration and development work on deep seated salt domes normally utilize the constant angle, on-course method.

B. E. Eakin

HUGHES GETS TURBODRILL. *Petrol. Week*, 2, 12 (1956) June 8.

Hughes Tool Company has signed an agreement with Meyrpic of France to develop a set of special rock bits for the French turbodrill.

B. E. Eakin

WILDCATTING STILL GAINING. *World Oil*, 142, 110 (1956) June.

In the first four months of this year 3896 wildcat tests were completed, an increase of 15.6 percent over 1955. Discovery rate was 11.3 percent of total drilled, down from last years 12.8 percent overall average. B. E. Eakin

## Fracturing

Mounce, W. D. (assigned to Esso Research and Eng. Co.) METHOD OF INCREASING PERMEABILITY OF A PRODUCING FORMATION. U. S. 2,746,551 (1956) May 22.

A method of increasing the ability of a formation to produce fluids is described. The method is based on introduction of a perhalogen acid into the formation, since perhalogen type acids explode in contact with hydrocarbons.

B. E. Eakin

## Future Pipe Lines

Sterrett, E. PIPELINING IN 1975—A PREVIEW. *Pipe Line News*, 28, 48-49 (1956) May.

An imaginative review of advances in pipelining achieved by 1975. G. G. Wilson

## Leakage Control

Abbott, A. H. CONTROL OF UNDERGROUND GAS LEAKAGE. *Gas*, 32, 76-78 (1956) April.

A general discussion of the leak detection and control procedures employed by the Northern States Power Co., Minneapolis.

G. G. Wilson

## Liquefied Natural Gas

Burns, J. and Clark, L. J. LIQUID METHANE. Instn. Gas Eng. Commun. No. 494; *Gas World* (British) 143, 1278-86 (1956) June 2; *Gas J.* (British) 286, 754, 759, 760, 765, 766, 769 (1956) June 6; *Coke and Gas* (British) 18, 208-10 (1956) June; *Gas Times* (British) 87, 350-51, 367, 369 (1956) June 15.

The availability of natural gas now wasted in foreign oil-producing regions has aroused the interest of British gas engineers in the development of ship transportation of liquefied gas. A brief review of history of processes, sources and reserves is given. Experience with design of low temperature storage tanks at Cleveland, Chicago (projected) and Moscow is outlined. Liquid gas tanker ships are discussed from the viewpoint of design, precautions, costs and "turn-around" operation, as compared to oil transport and construction of a trial ship is recommended. O. P. Brysch

## Microwave Systems

Hale, D. MICROWAVE SYSTEM MILEAGES, TECHNOLOGY CONTINUE TO GROW. *Petrol. Eng.*, 28, D89-90 (1956) May.

A summary of the growth and recent technical advances in the field of microwave communications an up-to-date tabulation of U. S. pipeline microwave systems keyed to a map of these systems is also included. G. G. Wilson

## Network Analyzer

Boyer, H. M. THE McILROY PIPELINE NETWORK ANALYZER. *Instruments and Autom.*, 29, 928-29 (1956) May.

A brief description of the McIlroy analog computor used as a gas piping network analyzer.

R. F. Bukacek

Herning, F. and Lugt, H. UEBER EIN HYDRAULISCHES ANALOGIEVERFAHREN FUER ROHRLEITUNGSNETZE MIT KOMPRESSIBLEN ODER INKOMPRESSIBLEN MEDIEN. (A HYDRAULIC ANALOGOUS PROCEDURE FOR DISTRIBUTION NETWORKS WITH COMPRESSIBLE OR INCOMPRESSIBLE MEDIUM.) *Gas- u Wasserfach* (German) 97, 449-52 (1956) June 1.

The development of a hydraulic analogous procedure is reported with the aid of which a difficult distribution problem can be solved in a simple and visual manner. The physical relations are given in particular which makes it possible to replace the resistance of a pipeline with a small orifice and to make an analogous network which can be used for a compressible

or incompressible medium. The original network is represented by a system of 1" diam. brass tubing whereby the resistance of the individual pipe sections of the original is replaced by small orifices and the flow quantities will be set with the aid of floats and very small proportionality factors of e.q. 1/6000. The small network is filled with compressed air of the same pressure as the original. This way the pressure can be read directly, and by reading the difference in pressures the flow quantity and its direction can be determined. The network represented was 370 km long and had 6 feed points and 4 mains. G. Kunst

## Nitrogen Removal

Newton, R. H. (assigned to Badger Manufacturing Co.) SEPARATION OF GASEOUS MIXTURES BY FRACTIONATION. U. S. 2,744,394 (1956) May 8.

A method for separating nitrogen from raw natural gas is presented. Above critical pressure is used and n-pentane is used as reflux. Countercurrent contact with liquid and vapor permits continuous overhead removal of nitrogen. Above critical pressure separation eliminates the recompression of product after a lower pressure separation. P. B. Tarman

## Pipe Line Flow

Bukacek, R. F. and Ellington, R. T. PROCEDURES FOR PIPELINE EFFICIENCY TESTING. Amer. Gas Assoc. Opertg. Sect Paper GSTS-56-3 (1956) May 10-11; *Pipe Line Ind.*, 5, 16-21 (1956) July.

Analyses of pipeline efficiency field test data, conducted at the Institute of Gas Technology in 1952 and 1953, disclosed inconsistencies in the data resulting from differences in measurement technique. These data also pointed out the measurement difficulties inherent in efficiency determination, the limitations of the various techniques employed, and the need for an evaluation of field measurement procedures and for development of criteria for judging the validity of field data. To satisfy this need, a set of preliminary recommendations for efficiency testing was developed, in 1954, which formed the basis for Project NB-13, sponsored by the Pipeline Research Committee as part of the PAR (Production, Advertising, and Research—Plan of the American Gas Association, in 1955. In carrying out this project, recommendations covering test equipment and procedures, a field data form, calculation methods and analysis of data for errors were developed. This report presents the recommended procedures, required test equipment and calculation methods for pipeline flow efficiency testing which were developed in Project NB-13. Authors' Abstract

Schomaker, J. F. and Hanna, L. E. HOW TO WORK THE REVISED PANHANDLE FORMULA. *Petrol. Eng.*, 28, D25-28, May; D47-49 (1956) June.

The revised Panhandle flow equation, which is based on flow test data obtained on Panhandle Eastern Pipelines system, is presented. A semigraphical method of solution is given with tabulated values for various multiplier terms, and 2 examples. R. F. Bukacek

## Pipe Lines

COASTAL GAS LINE LAID. *Oil Gas J.*, 54, 76 (1956) April 2.

A brief description of the terrain and construction techniques used on Tennessee Gas Transmission Company's 355-mile pipeline along the Louisiana Coastline. G. G. Wilson

KEEPING TEXAS GAS INTRASTATE. *Petrol. Week*, 2, 9-10 (1956) June 22.

The Texas Gas Corporation is building a new feeder line to connect to the Texas Eastern Transmission line and separate the interstate and intrastate gas lines. This will remove FPC control from the intrastate sales.

W. G. Bair

## Supercompressibility

Nelson, P. W. THE EFFECT OF SUPERCOMPRESSIBILITY ON GAS MEASUREMENT AND THE USE OF PRESENTLY PUBLISHED TABLES OF FACTORS TO CORRECT FOR THIS EFFECT. Amer. Gas Assoc. Operg. Sect. Paper GSTS-56-1 (1956) May 10-11.

Any calculation of a supercompressibility factor must take into consideration the presence of even small amounts of inerts such as nitrogen and carbon dioxide. A comparison of various methods is made here; all agree very closely if no inerts are present in gas. When inerts are

present any method will produce acceptable results as long as effects of nitrogen and carbon dioxide are recognized. Such methods as NGAA, CNGA, and A.G.A. were compared, as were computation and direct reading methods.

P. B. Tarman

### Synthetic Diaphragms

McDonell, W. C. and Sevey, C. J. SYNTHETIC DIAPHRAGMS FOR DOMESTIC GAS METERS. *Gas*, 32, 69 (1956) April.

The results of a program of testing positive displacement meters with synthetic diaphragms conducted by the Southern California Gas Co. are summarized. Both field test data and results from ultimate life tests indicate that meters with synthetic diaphragms have excellent life expectancy and maintain their accuracy when metering dry natural gas. G. G. Wilson

### Turbo-Booster

Tenney, C. M., Jr. GAS DISTRIBUTING SYSTEM. U. S. 2,740,701 (1956) April 3.

This patent covers the use of turbo-compressor units driven by high-pressure natural gas from a natural gas transmission pipeline to boost the pressure of low pressure peak-shaving gas to the levels requested for a high-pressure distribution system. The exhaust gas from the compressor is also injected into the high pressure distribution system. G. G. Wilson

### Underground Storage

Hunter, L. R. (assigned to Phillips Petroleum Co.) UNDERGROUND STORAGE SYSTEM. U. S. 2,749,714 (1956) June 12.

This invention relates to an improved type of cavern storage system for liquified petroleum gases. Claims include large capacity and low per unit investment cost, ease in access to and control of material in storage, and improved safety devices. B. E. Eakin

Viglini, J. P. HOW UNDERGROUND STORAGE RELATES TO GAS-PIPELINE OPERATION. *Oil Gas J.*, 54, 96-98 (1956) April 2.

The advantages of underground storage of gas to operators of gas pipelines are outlined and illustrated by use of data pertaining to the Lone Star Gas Co., Dallas. G. G. Wilson

## 6. PETROLEUM AND SYNTHETIC LIQUID FUELS

### Computer Applications

ESSO PIONEERS GIANT COMPUTER SYSTEM. *Oil Gas J.*, 54, 114-15 (1956) May 14.

Esso Standard Oil Co. is pioneering the use of giant electronic computers in the oil industry. Principal innovation in the new machine is the magnetic core memory which replaces the electrostatic memory used in earlier equipment. Esso also investigated on methods of using a computer and how it might integrate into the existing system. The general planning and helpful hints were outlined so that the transition to the actual computer can be expected to be smooth. G. Kunst

### Remote Controlled Pumps

Madden, P. R. REMOTE CONTROLLED, UNATTENDED PUMP STATIONS HIGHLIGHT MODERNIZATION. *Petrol. Eng.*, 28, D20-24 (1956) June; *Pipe Line News*, 28, 47, 48, 50-54 (1956) August.

A description is given of the Great Lakes Pipe Line Company's new controlled pumping system installed on the 6 and 8-inch products lines of the 305-mile "East Line" between Des Moines and Chicago. The controlling station at Iowa City, Iowa, operates the 3 eastward remote stations at Donahue, Iowa, and Prophetstown and Lee, Illinois, by relays and coded pulses over AT & T telegraph channels. Indicator, telemetering and supervisory equipment is described and a typical remote operation is given in detail. O. P. Brysch

### Shale Oil

Lochte, H. L. and Meyer, H. W. H. SOME COLORADO SHALE-OIL BASES. *J. Amer. Chem. Soc.*, 78, 2150-2153 (1956) May 20.

A combination of fractionation by distillation, by chloroform extraction of aqueous solutions of hydrochlorides, and by systematic fractional neutralization yielded Colorado shale-oil base fractions from which quinoline and isoquinoline and a series of methyl homologs were isolated and identified from material boiling from 227 to 239°, while similar separations of bases boiling from 264-290° yielded large amounts of 2,3,8-trimethylquinoline and a series of unidentified picrates but none of the very stable $C_{16}H_{25}N$ base found in high concentration in California petroleum bases. In general these

shale-oil bases formed much larger amounts of tar than did corresponding California petroleum base fractions. Authors' Abstract

### Waste Disposal

Hart, W. B. HOW NEW IS THE WASTE DISPOSAL PROBLEM? *Petrol. Refiner*, 35, 181-83 (1956) May; Calif. Oil World, 49, 4, 6-8, 10 (2 iss.) (1956) July.

The report of the API Committee on Disposal of Refinery Wastes (CDRW) to the Division of Refining at Montreal is discussed. The waste problem, its history and the activities of the waste disposal committee since 1929 are briefly reviewed. Initial pollution surveys, waste-oil separator design, analytical methods, biological and limnological studies of streams and preparation of "The Manual on Disposal of Refinery Wastes" are mentioned. O. P. Brysch

## 7. ANALYTICAL METHODS AND TESTS

### Automatic Analyzers

Wherry, T. C. AUTOMATIC PROCESS-STREAM ANALYZERS. *Oil Gas J.*, 54, 125-6, 129 (1956) May 28.

A discussion of selective and nonselective measurement systems for automatic process-stream analysis is presented. Instruments which measure refractive index, oxygen content, infrared and ultraviolet absorption are included.

D. V. Kniebes

### Calcium Method

Patton, J. and Reeder, W. NEW INDICATOR FOR TITRATION OF CALCIUM WITH (ETHYLENEDINITRILO) TETRAACETATE. *Anal. Chem.*, 28, 1026-28 (1956) June.

A new indicator for calcium, 2-hydroxy-1-(2-hydroxy-4-sulfo-1-naphthylazo)-3-naphthoic acid, has been synthesized which permits an accurate titration of calcium in the presence of magnesium with (ethylenedinitrilo) tetraacetate. The indicator produces a sharp, stable color change from wine red to pure blue. Calcium and magnesium separations are not necessary. Titration procedures for the determination of calcium and magnesium in water, limestone, salt, and boiler scale are described. The usual ammonia-ammonium chloride buffer is replaced by an odorless monoethanolamine-hydrochloric acid buffer containing complexed magnesium. Authors' Abstract

### Gas Analysis

Drew, C. M., McNesby, J. R., and Gordon, A. S. APPLICATION OF VAPOR-PHASE CHROMATOGRAPHY TO MASS SPECTROMETER ANALYSIS. *Anal. Chem.*, 28, 979-83 (1956) June.

A description is given of a technique for analysis of complex gaseous mixtures by vapor-phase chromatography, and position identification of fractions having equal emergence times by means of the mass spectrometer.

J. E. Neuzil

### Infrared Methods

Littman, F. E. and Denton, J. Q. INFRARED SPECTROMETRIC METHOD FOR MONITORING GASEOUS ORGANIC SUBSTANCES IN ATMOSPHERE. *Anal. Chem.*, 28, 945-49 (1956) June.

A nondispersive infrared gas analyzer was modified so that it was suitable for recording changes in the concentration of gaseous organic substances in the atmosphere. This work was undertaken for the monitoring of the atmosphere because of the importance attributed to organic substances in the formation of smog in the Los Angeles area. Organic concentrations in the rante 0.1 to 10 p.p.m. are detected.

E. Mann

### Oxygen Meter

Hobson, A. and Kay, R. H. TWO DESIGNS FOR A PARAMAGNETIC OXYGEN METER. *J. Sci. Instrum.* (British), 33, 176-81 (1956) May.

This paper describes two investigations of the design of an oxygen concentration meter which is based on the paramagnetism of oxygen and the change of its susceptibility with temperature. D. V. Kniebes

## 8. GENERAL AND PHYSICAL CHEMISTRY

### Carbon–Sulfur

Sykes, K. W. and White, P. THE REACTIONS OF CARBON WITH SULFUR COMPOUNDS. *Faraday Soc. Trans.* (British), 52, 660-671 (1956) May.

A general survey has been made of the interaction of gaseous sulfur and carbon disulfide with coconut charcoal in the pressure range $10^{-4}$ to $10^{-2}$ mm at 627-927° C. Rates and

equilibria for adsorption and desorption have been discussed, in terms of fundamental theory, according to a scheme which postulates the chemisorption of sulfur and carbon disulfide as distinct but inter-convertible entities. Diffusion within the granules was found to be an important kinetic factor; its influence is consistent with the known structure of the charcoal and an extension of Wheeler's treatment of diffusion control in porous catalysts. Authors' Abstract

### Film Permeability

Heilman, W., Tammela, V., Meyer, J. A., Stannett, V., and Szwarc, M. PERMEABILITY OF POLYMER FILMS TO HYDROGEN SULFIDE GAS. *Ind. Eng. Chem.*, 48, 821-24 (1956) April.

The results of experimental determinations of the permeability of several polymer films to hydrogen sulfide gas are presented. The films studied included nylon, polyethylene, saran and cellulose acetate. The results are presented in terms of the permeability, diffusivity, and solubility of hydrogen sulfide for each film as a function of temperature. G. G. Wilson

### Ion Exchange Resins

Winter, S. S. THE PHYSICAL CHEMISTRY OF POLYELECTROLYTES AND ION-EXCHANGE RESINS. *J. Chem. Education*, 33, 246-52 (1956) May.

The viscosity, ionization, and transport properties of polyelectrolytes, and the physical and exchange properties of ion exchange resins are reviewed. D. M. Mason

### Paraffin Oxidation

Bransom, S., Hanlon, L. and Smythe, B. THE OXIDATION OF PARAFFINS BY COPPER OXIDE. *Faraday Soc. Trans.* (British), 52, 672-680 (1956) May.

The reaction between simple paraffins and copper oxide displays two stages which differ kinetically. The first stage has a relatively short duration and is attributed to reaction with oxygen in equilibrium with CuO. The second stage is controlled by the diffusion of $Cu^+$ ions in $Cu_2O$, the reaction mechanism being $Cu_2O \rightarrow O^{2-} + 2Cu^+$; $Cu^+ + CuO \rightarrow Cu_2O +$ positive hole. The reactions of the large paraffin molecules, $C_5$ to $C_7$, display a form of poisoning which is attributed to polarization due to the accumulation of $Cu^+$ ions close to the reaction site. The adsorption of paraffin molecules as acceptors on $Cu_2O$ is assisted or promoted by reaction occurring with $O^{2-}$ ions at the surface. Authors' Abstract

## 9. ORGANIC CHEMISTRY

### Acetylene Recovery

Bartholomé, E., Lehrer, E., and Lorenz, L. SEPARATION OF ACETYLENE FROM GASEOUS MIXTURES. U. S. 2,738,859 (1956) March 20.

Acetylene of high purity is produced by a system involving separation of acetylene from acetylene-bearing gaseous mixtures by means of selective absorption of the mixture by a mixture of water with an excess of an organic solvent. This organic solvent must have power to dissolve acetylene, and it must be at least partially miscible with and have a higher boiling point than water. H. L. Feldkirchner

Fusco, V. C. (assigned to Olin Mathieson Chem. Corp.) SELECTIVE REMOVAL OF ACETYLENE FROM ACETYLENE-ETHYLENE MIXTURES. U. S. 2,742,517 (1956) April 17.

Acetylene is selectively removed from mixtures of acetylene and ethylene by absorptive contact of the gas mixture with a suspension of potassium hydroxide (or a mixture of sodium-hydroxide) in a non-aqueuous organic solvent. H. L. Feldkirchner

### Catalytic Hydrogenation

Lobo, P. A., Sliepcevich, C. M., and White, R. R. STEEL-CATALYZED HYDROGENATION OF CARBON MONOXIDE AND DIOXIDE. *Ind. Eng. Chem.*, 48, 906-12 (1956) May.

The hydrogenation of carbon monoxide and dioxide to light hydrocarbons was investigated at 1050° F. over carbon steel balls in a continuous pilot plant suitable for operation at 25,000 psi and 900° F. and 10,000 psi at 1200° F. The effect of pressure on the product distribution obtained over the pressure range 30 to 1040 atm. was studied. The effect of carbon dioxide addition to a carbon monoxide-hydrogen feed gas on the hydrocarbon to carbon dioxide ratio in the product gas was investigated also. A number of runs were conducted to evaluate the effect of pretreatment and oxidation on the activity of the steel catalyst. Authors' Abstract

## Gas Chemicals

TOP PETROCHEMICAL SOURCE: NATURAL GAS. *Chem. Eng. News*, 34, 2744-6 (1956) June 4.

Ammonia, methanol and other established gas chemical industries will continue to be major consumers of natural gas. Acetylene is certain to grow as a new consumer. To avoid FPC control most new plants will be built near the wells, unless captive supplies or pipelines "for chemicals only" are developed. Refinery gas as a raw material will probably be used in new ammonia plants, but not for methanol or ethylene. Petroleum will be used increasingly for carbon black and aromatic hydrocarbon manufacture. Growing commercial processes such as the nitro-paraffin, oxo, Fischer-Tropsch, Texaco partial oxidation, and hydrogen cyanide are based specifically on natural gas or natural gas liquids. Before shifting to coal as a source, more gas will be diverted from industrial fuel use. O. P. Brysch

## Thiophenes

Levitt, L. S. PROCESS FOR THE PURIFICATION OF THIOPHENE. U. S. 2,745,843 (1956) May 15.

Foul-smelling sulfur-containing impurities in thiophene can be removed by treatment with dilute nitric or nitrous acid or the oxidizing nitrogen oxides with proper control of concentration, temperature, and time. The product from such treatment has a pleasant aromatic odor much like that of benzene.

D. M. Mason

Pennington, R. E., Finke, H. L., Hubbard, W. N., Messerly, J. F., Frow, F. R., Hossenlopp, I. A. and Waddington, G. THE CHEMICAL THERMODYNAMIC PROPERTIES OF 2-METHYLTHIOPHENE. *J. Amer. Chem. Soc.*, 78, 2055-60 (1956) May 20.

The properties reported here are the specific heat of the solid, liquid, and vapor, the heat of fusion, entrophy at the standard state, heat of vaporization, the second virial coefficient in the equation of state and the standard heat of formation of the liquid. Tables of thermodynamic properties at selected temperatures from 0 to 1000°K were computed. D. M. Mason

CHEMICO UREA SYNTHESIS USING EXCESS $NH_3$ FOR HIGH CONVERSION. *Petrol. Processing*, 11, 127-9 (1956) May.

A flow sheet and process description are given for the Chemico cycle for synthesis of urea from ammonia and carbon dioxide. Liquid $NH_3$ and $CO_2$ in a ratio of 6:1 are reacted in an autoclave at 347-365°F and 4100 psig without catalyst. Conversion of 76% to urea is obtained and excess $NH_3$ is separated by distillation for recycle to the reactor. J. M. Reid

# 10. CHEMICAL ENGINEERING

## Bubble-Cap Trays

Bolles, W. L. OPTIMUM BUBBLE-CAP TRAY DESIGN: PART IV: DESIGN EXAMPLE. *Petrol. Procg.*, 11, 109-20 (1956) May.

This article presents step by step an example tray design. A very complete treatment is given.

R. F. Bukacek

## Heat Transfer

Johnstone, R. E. THE SCALING-UP OF HEAT TRANSFER COEFFICIENTS. *Inst. Chem. Eng. Trans.* (British), 33, 243-51, No. 4 (1956).

A direct scale-up of pilot plant values is recommended for determining full scale heat transfer coefficients. If the compositions and the mean temperatures of the process fluids are the same for the small and large scale, then the effects of physical properties cancel out in the scale-up. For geometrically similar heat transfer surfaces in the pilot plant and full-sized unit, the shape factor also cancels out resulting in a simple power relation between the heat transfer rate, fluid velocity or temperature difference, and scale ratio. Scale relations are derived from standard design equations for forced convection (Dittus-Boelter Equation), natural convection (Lorenz Equation), condensation (Nusselt Equation) and for overall coefficients, and applicability is discussed. Validity of the scale-up relation was verified experimentally with tests on a model and a full-sized hemispherical steam jacketed pan.

E. J. Pyrcioch

### Maintenance

Bale, E. S., Mast, E. L., and Wester, R. E. HOW TO MEASURE MAINTENANCE RESULTS. *Petrol. Refiner*, 35, 159-65 (1956) May.
The reasons for maintenance, and several new ways to measure its effectiveness are reviewed.
W. G. Bair

### Meter Problems

Hutchison, A. M. TEST CHARTS FOR GREATER ACCURACY. *Amer. Gas Assoc. Monthly*, 38, 31-33, 53 (1956) May.
The effects of changes in relative humidity on meter charts is discussed and the results of tests showing the magnitude of chart dimension changes are given. R. F. Bukacek

Lee, C. A. HOW TO MOVE AND METER LIQUIFIED GASES. *Chem. Eng.*, 63, 193-195 (1956) May.
The problems associated with pumping and measuring the flow of volatile liquid hydrocarbons are reviewed, and some very practical suggestions offered. B. E. Eakin

Pifer, W. G. WHAT'S AHEAD IN GAS METERS? *Gas Age*, 117, 38-39 (1956) May 3.
The wider use of synthetic rubber, powder metallurgy and plastics is forecast for meter construction. R. F. Bukacek

### Reactor Design

Coopey, W. HOLDING HIGH-PRESSURE JOINTS. *Petrol. Refiner*, 35, 189-93 (1956) May.
Several basic designs for pressure vessel closures are reviewed. The flat gasket joint, the Bridgman, Casale and lens ring closures, wave ring and "O" ring joints are discussed. Particular attention is given to the Delta ring joint invented by the author. Drawings and design criteria are presented. E. B. Shultz

Gasche, F. DESIGN OF REACTORS AND CLOSURES. *Ind. Eng. Chem.*, 48, 838-40 (1956) May.
Practical design of chemical reactors for extreme temperature and pressure conditions are discussed. The limitations of ASME code formulas for design purposes are demonstrated and working rules for vessel design are given when codes are no longer applicable. Modern closure design is considered and compared with previous practice. The merits of the major types of closures now available are described in some detail. E. B. Shultz, Jr.

Voorhees, H. R., Sliepcevich, C. M. and Freeman, J. W. THICK-WALLED PRESSURE VESSELS. *Ind. Eng. Chem.*, 48, 872-81 (1956) May.
Typical formulas which have been used to design pressure vessels are reviewed in terms of rupture life at elevated temperatures. Results of tests of behavior under variable and complex stresses are given and a calculation method is illustrated for stress distribution under creep conditions. A novel duplex design for reactors under extreme conditions is suggested.
E. B. Shultz, Jr.

### Water Economy

Elkin, H. F. HOW SUN OIL LICKED ITS WATER PROBLEM. *Oil Gas J.*, 54, 118-20 (1956) May 28.
Additional water demand due to expansion of Sun's Toledo refinery has been satisfied without increasing the water supply, by reuse of water. Steps taken to achieve this include installation of a flue gas stripping tower to remove sulfides from process waste waters to be reused; segregation of low alkalinity process waste waters together with storm run-off and storage in an impounding basin where preliminary biological oxidation occurs, and provision of a cooling tower system for cooling and for removal of phenol by biological oxidation. D. M. Mason

## 11. PROCESS EQUIPMENT AND INSTRUMENTATION

### Control Valves

Beard, C. S. ACTUATOR DESIGN. *Instrum. and Autom.*, 29, 895-97 (1956) May.
Chapter 5 of a series on control valves, this article deals with the basic forces that the activator must overcome and with manual activators which can be used with other activators.
R. F. Bukacek

STANDARD CLASSIFICATION AND TERMINOLOGY FOR POWER-ACTUATED VALVES. *Instrum. and Autom.*, 29, 898-900 (1956) May.
A proposed standard classification and terminology for power-actuated valves is presented and recommended for general adoption.
R. F. Bukacek

Washburn, W. D. and Milham, R. TERMINOLOGY OF CONTROL VALVES. *Instrum. and Autom.*, 29, 901-03 (1956) May.

A partial classification of process control valve terminology is outlined. R. F. Bukacek

### Electrical Equipment

LONE STAR GAS ADOPTS NEW TESTING TECHNIQUE FOR ELECTRICAL EQUIPMENT. *Amer. Gas J.*, 183, 27, 30 (1956) April.

A protective maintenance program for circuit breakers and motor starter overload relays used by Lone Star Gas Co., is briefly described. The basic test instrument used is a device which can produce high currents in stepless increments. G. G. Wilson

### Gas Detector

GAS DETECTION SYSTEM GUARDS AUTOMATIC REGULATOR STATION. *Ind. Heating*, 23, 742, 744, 872 (1956) April.

The use of a Mine Safety Appliance Co. combustible gas alarm system to monitor the combustible gas content of the atmosphere in an automatic regulator station of the Philadelphia Gas Works is described. G. G. Wilson

## 12. MATERIALS OF CONSTRUCTION

### Cathodic Protection

Heverly, L. F. VOLTMETERS AND AMMETERS USED IN CATHODIC PROTECTION MEASUREMENTS. *Pipe Line News*, 28, 62 (1956) May.

A brief summary of the types of voltmeters and ammeters used in cathodic protection work and of the manner in which they are used to make several different types of field measurements. G. G. Wilson

### Coatings

Cranmer, W. W. RECENT NAVY EXPERIENCE WITH SARAN AND VINYL COATINGS. *Corrosion*, 12, 245t-46 (1956) May.

A summary of the experience of the U. S. Navy in the use of a vinylidene acrylonitrile copolymer lining for use in submarine tanks and gasoline cargo tanks of tankers and of vinyl coatings for U. S. Navy ships. G. G. Wilson

Corfield, G. CORROSION PREVENTION. *Gas*, 32, 92, 94-95 (1956) April.

A brief summary of three years experience of the Arizona Public Service Co. with prefabricated plastic tape as an underground pipe coating. G. G. Wilson

PIPE CONCRETED IN FORM. *Pipe Line News*, 28, 30-31 (1956) May.

More uniform concrete thickness is claimed for a process of applying concrete coating to fourteen-inch pipe thickness by a moulding process. This process, developed by Anchor-Wate Co., Houston, Texas is described and illustrated pictorially. G. G. Wilson

REPORT ON EPOXY RESINS. *Corrosion*, 12, 187t-90 (1956) April.

This report, prepared by Technical Unit Committee T-6A of NACE, briefly summarizes the physical and chemical properties of the epoxy-resins, the forms in which they are available, and methods of applying epoxy resins coatings. G. G. Wilson

### Corrosion

Francis, H. T. CORROSION-RESISTANT STRUCTURAL MATERIALS. *Machine Design*, 28, 104-07 (1956) May 31.

A brief summary of corrosion theory, methods of corrosion prevention, and the corrosion properties of currently available structural materials. G. G. Wilson

Greene, N. D. CORROSION TESTING AT HIGH TEMPERATURES. *Chem. Eng.*, 63, 175-80 (1956) April.

A discussion of the problems encountered in high-temperature corrosion testing, of the special equipment required for this type of test work and difficulties involved in the interpretation of the results obtained. G. G. Wilson

### Hydrogen Attack

Neumaier, B. W. and Schillmoller, C. M. DETERRENCE OF HYDROGEN BLISTERING AT A FLUID CATALYTIC CRACKING UNIT. *Petroleum* (British), 19, 155-60 (1956) May; Petr. Ref. 35, 146-9 (1956) May.

Efforts to avoid low-temperature hydrogen attack at a new fluid catalytic cracking unit of the Richfield Oil Corporation, Wilmington, Calif., have been successful as a result of cor-

rosion prevent in the design stage and corrosion control during operation. When the unit was shut down recently after more than a year of successful and continuous operation it was found to be in excellent condition. The following is the first half of a paper presented before the American Petroleum Institute's Refining Division last year, and before the National Institute of Corrosion Engineers' Annual Meeting this year. The authors describe the different forms of hydrogen damage and the prevention steps that were taken. Preliminary evaluation by hydrogen probes, painted-can tests and chemical analyses were employed to detect any hydrogen penetration taking place before the routine shut-down enabled internal inspection to be carried out. Authors' Abstract

Perlmutter, D. D. and Dodge, B. F. EFFECTS OF HYDROGEN ON PROPERTIES OF METALS. *Ind. Eng. Chem.*, 48, 885-93 (1956) May.
Fifty different metals and alloys were exposed to hydrogen at 7500 to 60,000 psi at room temperature, and 15,000 and 30,000 psi at temperatures up to 500°C. Tensile strength, yield strength and ductility were measured and stress-strain plots of the elastic region, microscopic metallographic views and quantity of hydrogen retained by exposed specimens were obtained. Theories of embrittlement and attack are discussed and degree of hydrogen embrittlement is related to hydrogen content by a simple bend test. E. B. Shultz, Jr.

## $H_2S$ Corrosion

Sorrell, G. and Hoyt, W. B. COLLECTION AND CORRELATION OF HIGH TEMPERATURE HYDROGEN SULFIDE CORROSION DATA. *Corrosion*, 12, 213t-34 (1956) May.
A report of the NACE Task Group T-5 B-2, in which data on corrosion by gas mixtures containing hydrogen sulfide at elevated temperatures is reviewed and correlated. This data shows that the rate of this corrosion depends primarily on temperature and hydrogen sulfide concentration and curves of corrosion rate as a function of these variables are presented. The nature and mechanism of hydrogen sulfide corrosion is also discussed. Sixteen abstracts of published and sixteen abstracts of unpublished corrosion data and 86 references are included. G. G. Wilson

## Inhibitors

Fischer, H. INHIBITION AND INHIBITORS. *Ind. Finishing* (British), 9, 486-88, 490-91, 505 (1956) April.
A lecture given at the 1954 corrosion conference held in Frankfurt a/Main. The types of inhibitors are briefly described and the manner in which they function is outlined. Technical aspects of the use of inhibitors are also discussed. G. G. Wilson

Poetker, R. H. and Stone, J. D. SQUEEZING INHIBITOR INTO FORMATION. *Petrol. Eng.*, 28, B29-34 (1956) May.
A new method of treating corrosion in gas-lift wells by squeezing inhibitors back into the formation is described. This squeeze treatment is accomplished by use of a small triplex pump and a small centrifugal pump to pump inhibitor into the wells. Two case histories illustrating results obtained with this method are included. G. G. Wilson

## Metal Surface Films

Bisson, E. E., Johnson, R. L., Swikert, M. A. and Godfrey, D. FRICTION, WEAR, AND SURFACE DAMAGE OF METALS AS AFFECTED BY SOLID SURFACE FILMS. Nat. Adv. Comm. Aeron. Techn. Note 3444 (1955) May.
Data is presented on the effect of surface films of oxide, chlorides and sulfides on friction. Methods of applying films are discussed. D. V. Kniebes

## Plastic Equipment

Fontana, M. G. CORROSION: EQUIPMENT MADE FROM MODIFIED EPOXY DURCON RESINS. *Ind. Eng. Chem.*, 48, 87A (1956) April.
The utility of modified epoxy resins produced by The Durcon Company in the construction of chemically resistant equipment is discussed. The mechanical, physical, and chemical properties of the resins used are summarized and examples are given of equipment constructed from them. G. G. Wilson

McFarland, R., Jr. CHLOROSULFONATED POLYETHYLENE (HYPALON) AS A CONSTRUCTION MATERIAL FOR CHEMICAL EQUIPMENT. *Corrosion*, 12, 197t-98 (1956) May.
The physical and chemical properties and prom-

ising applications for hypalon are briefly summarized. G. G. Wilson

NACE. REPORT ON RIGID POLYVINYL CHLORIDE. *Corrosion*, **12**, 183t-86 (1956) April.

This report, prepared by Technical Unit Committee T-6A of the National Association of Corrosion Engineers, briefly summarizes the mechanical and chemical properties of rigid polyvinyl chloride, its uses, the forms in which it is available, and methods of uses in its fabrication. G. G. Wilson

### Rare Earths

Vickery, R. C. THE RARE EARTHS—UP FROM OBSCURITY. *Research and Eng.*, **11**, 28-31 (1956) April.

The rare earths, the elements of periodic group III A, scandium to lutetium, form a group of seventeen long known for the extreme difficulty of their separation from one another. Because of their considerable occurrence in the "ashes of the atomic bomb", intensive studies have developed the ion-exchange method for comparatively rapid separation of sufficient quantities for study. Tabulated properties and applications are given, which indicate future application in alloy metallurgy, optical ceramics, electronic and magnetic elements and special catalysts. O. P. Brysch

### Water Treatment

Olive, M. J. CATHODIC PROTECTION TEAMS UP WITH WATER TREATMENT TO STOP CORROSION. *Oil Gas J.*, **54**, 220, 223, 224, 227 (1956) April 16; *Petrol. Ref.*, 35, 188-91 (1956) April.

Dianodic water treatment (at pH of 6.0 to 6.5) using phosphate-chromate on the cooling water of the Arkansas Fuel Co's Greggton gasoline plant proved far more effective in reducing corrosion in the condensers than was dichromate alone. However, the heavy concentration of impurities still contributed to deposits and pitting. Experiments showed that several 2-lb magnesium anodes, coated with neoprene to control exposed area, and bolted to the channels, tube sheets and floating heads, stopped the corrosion and scale deposition. A saving of $123 first year and $150 second year labor cost per condenser was obtained. G. G. Wilson

## 13. NEW BOOKS

(C. A. Simms, Librarian)

### Chemical Processes

Drew, T. B. and Hoopes, J. W., Jr. ADVANCES IN CHEMICAL ENGINEERING. New York: Academic Press, Inc., 1956.

Advanced theories on boiling of liquids, diffusion, thermal and material transport, non—Newtonian fluid mechanics, extraction, radiation in chemical processing, and the use of the automatic computer are presented. Noted scientists in each field present their views. P. B. Tarman

Kammermeyer, K. and Osburn, J. O. PROCESS CALCULATIONS. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1956.

The elementary principles in process calculations are covered. Material, heat and energy balances for mixing operations, chemical reactions, and various flow processes are discussed in detail. Many numerical examples of fuel and gas combustion problems are also included. Trial and error solutions and graphical methods of solution for more difficult problems are also explained. P. B. Tarman

### Gas Construction

Gas Appliance Mfrs. Assoc., Inc. NATURAL GAS CONSTRUCTION DATA: January, 1956 Edition. New York: GAMA (1956) June.

This report brings up to date (January, 1956) the cumulative annual construction and growth of the gas industry. Six tables gave cumulative and also supplementary 1955 data, listed by city, gas company, and total and major authorized and pending construction. Table 7 is an addenda of recent data through May, 1956. O. P. Brysch

### Radioactive Processing

U. S. Atomic Energy Comm. CHEMICAL PROCESSING AND EQUIPMENT. New York: McGraw-Hill Book Co., 1955.

The handling of radioactive material is discussed in detail. Processing, plant design, ventilation and venting, waste disposal, equipment design, storage, and instrumentation problems are presented and solved. Contamination and its prevention is also covered. P. B. Tarman

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Association for Computing Machinery, Journal
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British Coal Utilization Research Association Monthly Bulletin and Quarterly Gazette
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Chemical Engineering
Chemical Engineering Costs Quarterly
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Chemistry and Industry
Coal Heat
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Gas Age
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Gas Council (British) Publications
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Gas Journal
Gas Times
Gas und Wasserfach
Gas World

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Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas (American)
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Institute of Fuel (British). Journal
Institute of Gas Technology Publications
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Journal des Usines a Gaz
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Journal of Scientific Instruments

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Mathematical Aids
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National Advisory Committee for Aeronautics, Reports
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News

Official Gazette of the U.S. Patent Office
Oil and Gas Journal

Petroleum
Petroleum Engineer
Petroleum Processing
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